Nov. 8, 1932. R. C. BRETT 1,886,937

FURNACE CONSTRUCTION

Filed Dec. 20, 1930 3 Sheets-Sheet 1

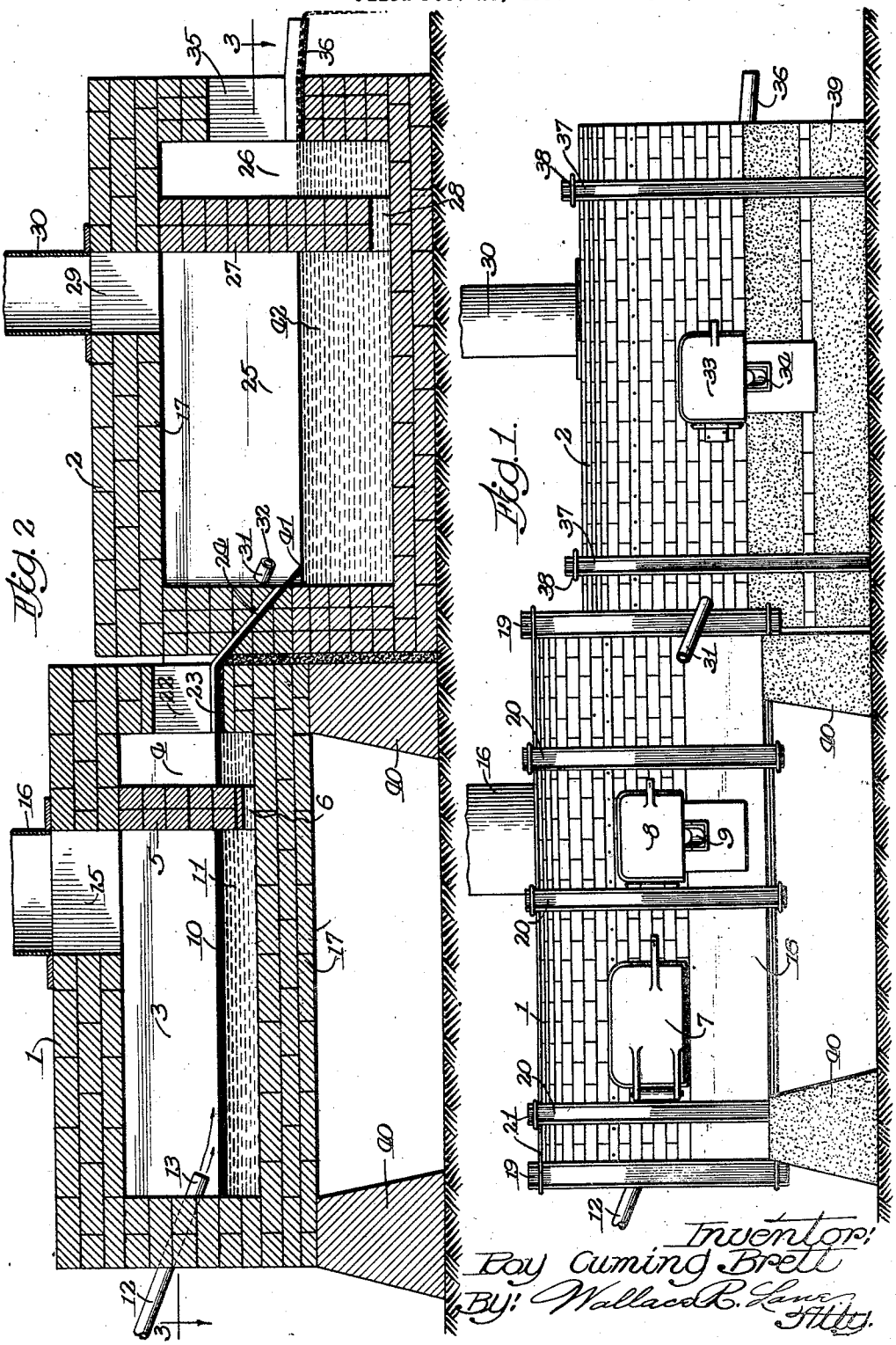


Fig. 2

Fig. 1.

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FURNACE CONSTRUCTION

Filed Dec. 20, 1930 3 Sheets-Sheet 2

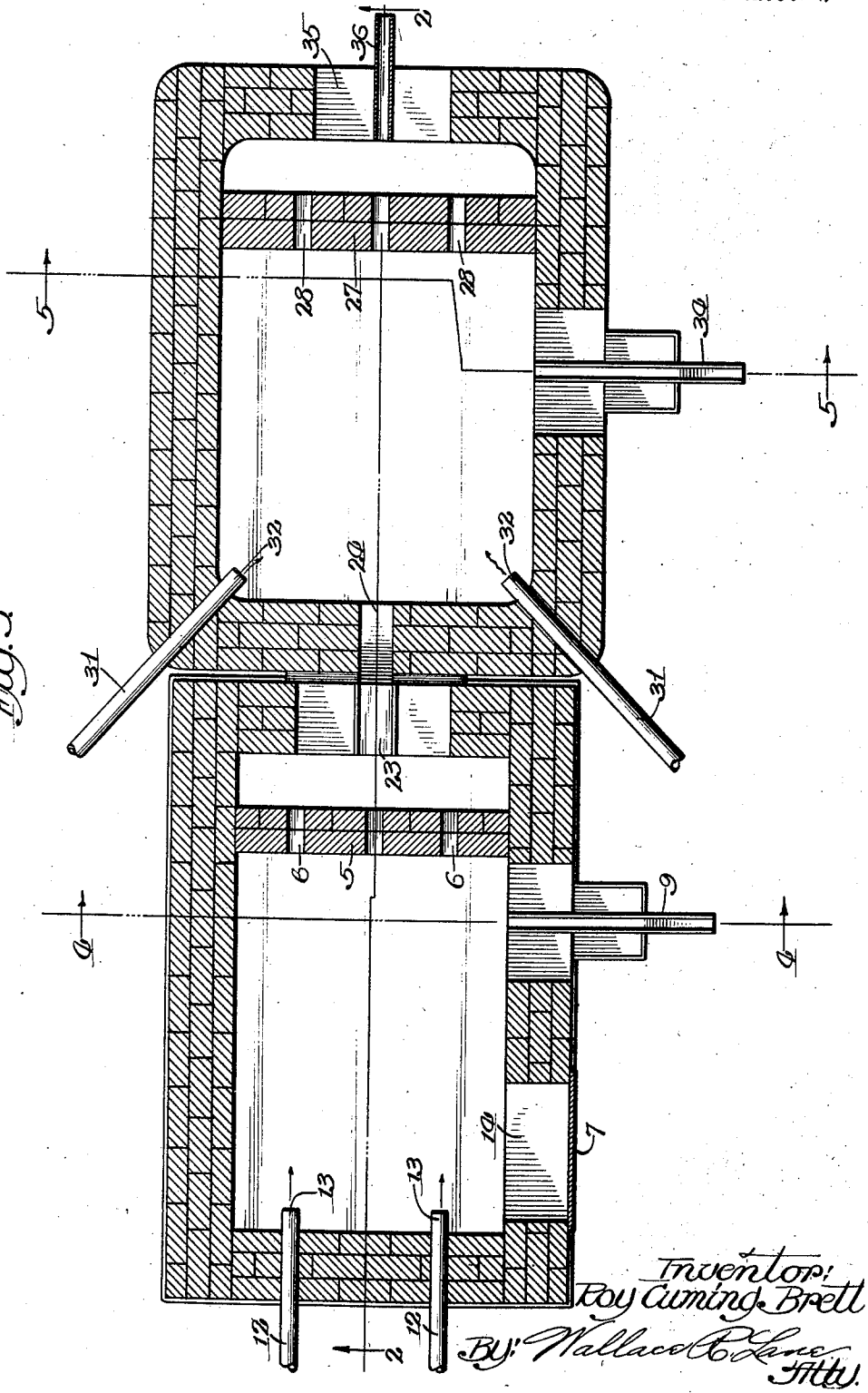


Fig. 3

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Nov. 8, 1932. R. C. BRETT 1,886,937

FURNACE CONSTRUCTION

Filed Dec. 20, 1930 3 Sheets-Sheet 3

Fig. 4.

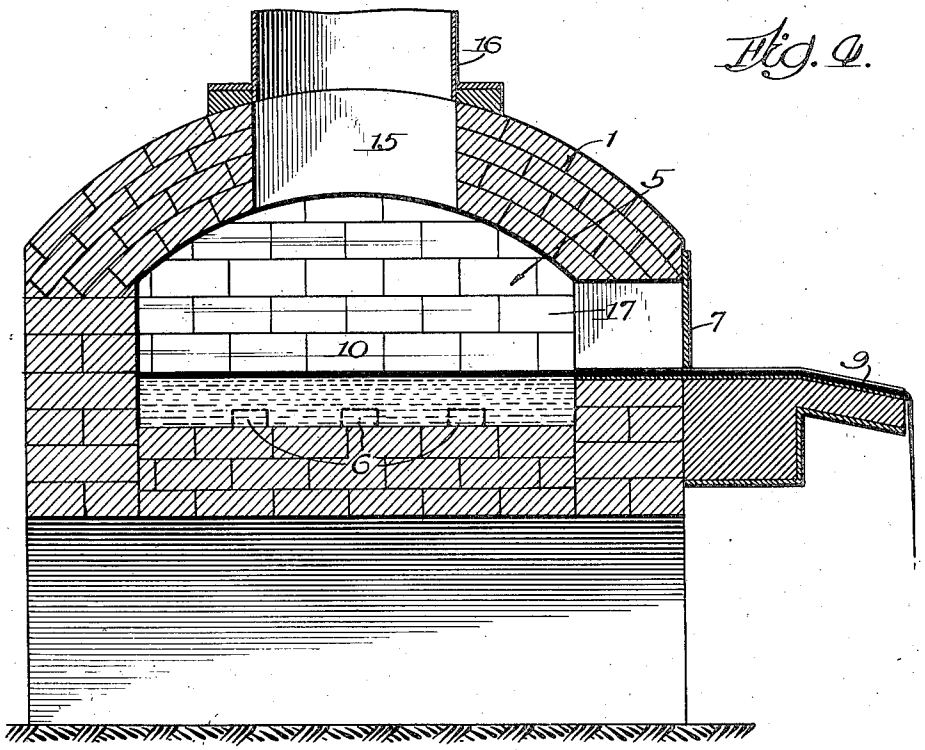
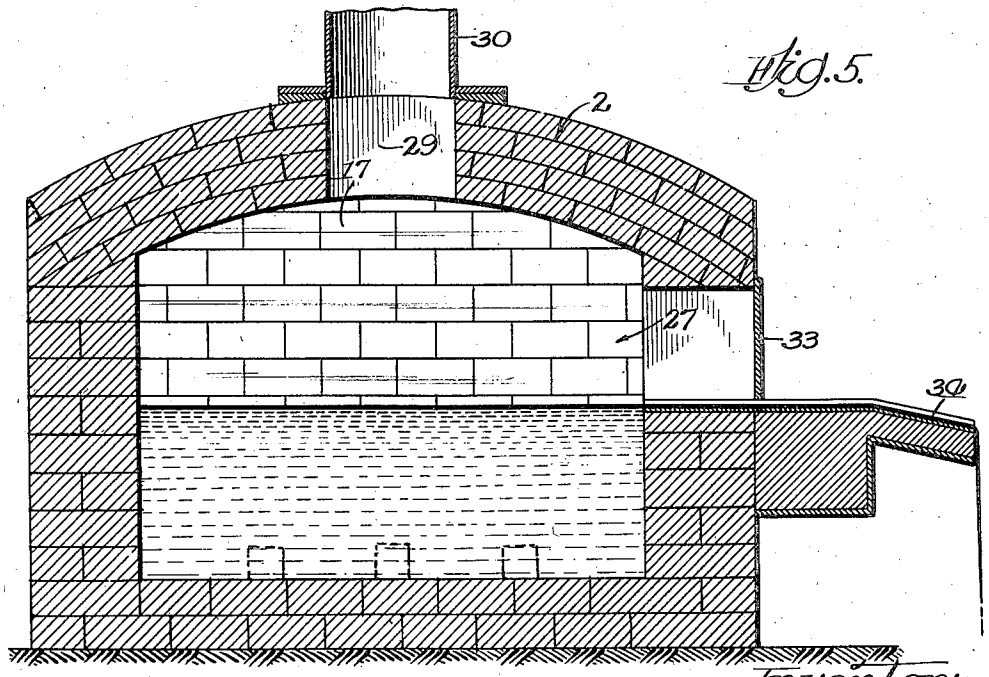


Fig. 5.



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UNITED STATES PATENT OFFICE

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FURNACE CONSTRUCTION

Application filed December 20, 1930. Serial No. 503,649.

The present invention relates to furnace constructions, and more in particular to such a construction adapted for use in the reclaiming of relatively pure lead.

The present invention deals with a furnace construction and means adapted to reclaim soft lead from impure lead and lead alloys as represented in various scrap, the most important of which is battery scrap comprising the positive and negative plates of storage batteries. These battery plates when new or fully charged, are composed essentially of lead, the negative plates having been prepared by pasting litharge (PbO) in an ordinary battery grid and connected as a cathode with a lead sheet as an anode in a bath of dilute sulphuric acid. Hydrogen set free on passage of current therethrough reduces the litharge to spongy metallic lead (Pb). The positive plates are grids pasted with red lead (Pb_3O_4), with a small percentage of litharge. When connected as cathodes in dilute sulphuric acid, the current changes the red lead to lead peroxide (PbO_2). Antimony added to the lead grids, gives the requisite stability thereto and resists the action of the sulphuric acid (H_2SO_4) and will not set up local action with either the spongy lead of the negative plates, or the lead peroxide of the positive plates.

As the lead making up the sets of plates may be partially or wholly converted by the sulphuric acid (H_2SO_4) acting thereon, nevertheless, the lead in one form or another remains in the battery, and when the battery is scrapped, this lead forms a considerable factor in the production of pure lead. The present invention contemplates the provision of means for converting this impure lead, and particularly battery scrap, to a reclaimed, relatively pure soft lead which can again be used in the production of battery plates or in other uses where a relatively pure lead is essential. When the number of automobiles are considered, and it is realized that all of those cars are equipped with storage batteries having a life of one to two years, it will be readily seen that the present invention is of the utmost importance to the industry.

Among the objects of the present invention is to provide a furnace construction adapted for the reclaiming of relatively pure lead from various lead alloys or compositions and impure lead. The present embodiment for carrying out the reclaiming of the relatively pure lead, contemplates the provsion of two furnaces set in series so that the reclaimed lead that emerges from the second furnace is in a purer state than is possible where but a single stage of purification is provided. Although but two stages of smelting the impure lead are disclosed, it is of course to be understood that more stages may be added if it is desired to still further reduce the antimony content of the refined lead, or but a single stage may be provided if desired.

A further object of the invention is the provision of a novel furnace construction provided with means for continuously separating out the impurities accumulating on the surface of the molten mass, and also continuously separating the relatively pure lead from adjacent the base of the furnace. The invention contemplates the provision of a bridge wall in the furnace chamber separating this chamber into two compartments, the same being connected only near the base of the bridge wall so that only relatively pure lead may have access to the second or smaller compartment.

A still further object of the invention is the provision of gravity feed of the separated relatively pure lead from the initial furnace to the second furnace, and from the second furnace, so that the reclaiming may be done continuously. The slag or impurities forming on the surface of the relatively pure lead in the furnaces, also flows by gravity into receptacles provided therefor, so that there is a continuous drainage of such impurities whereby to prevent the building up of the same.

Another object of the invention is the provision of a novel means of firing the furnace in order to substantially instantaneously convert the added material into a molten mass at a sufficient rate to prevent the ingredient or ingredients which are to be removed, and which will be hereafter referred to as impurities, the primary impurity of

which is antimony, from diffusing through the bath of molten relatively pure lead, such impurities at the same time spreading out on the surface of the pure lead so as to be readily and effectively reduced.

Further objects are to provide a construction of maximum simplicity, efficiency, economy and ease of assembly and operation, and such further objects, advantages and capabilities as will later more fully appear, and are inherently possessed thereby.

The invention further resides in the combination, construction and arrangements of parts illustrated in the accompanying drawings, and while I have shown therein a preferred embodiment, it is to be understood that the same is susceptible of modification and change, and comprehends other details, arrangements of parts, features and constructions, without departing from the spirit of my invention.

Referring to the drawings:

Fig. 1 is a view in side elevation of the furnace construction.

Fig. 2 is a view in vertical cross section taken in a plane represented by the line 2—2 of Fig. 3.

Fig. 3 is a view in horizontal cross-section taken on the irregular line 3—3 of Fig. 2.

Fig. 4 is a view in vertical cross section taken on the line 4—4 of Fig. 3.

Fig. 5 is a view in vertical cross section taken on the irregular line 5—5 of Fig. 3.

Referring more particularly to the disclosure in the drawings, the embodiment selected to illustrate the invention is shown as comprising furnaces 1 and 2, so positioned that molten metal flowing from the discharge spout of the first furnace, flows by gravity into the main compartment of the second furnace. In order to permit such gravity flow, this second furnace is set at a lower level. The interior of the initial furnace 1 is divided into two compartments, a relatively large compartment or charging chamber 3, and a smaller compartment or refining chamber 4, these two compartments or chambers being separated by a bridge wall 5 extending for the full height and width of the interior of the furnace, thereby preventing any access to the refining chamber 4 from the chamber or compartment 3 except through openings 6 provided in the bridge wall adjacent the base of the furnace. In a side wall or front of the furnace is provided a charge door 7 for the admission of the lead alloy or impure lead which is to be reconverted into a relatively pure lead. A door 8 is also provided in this side or front of the furnace permitting access to the interior of the charging chamber. Directly below this door 8 is provided a slag overflow 9 permitting a continuous drain or discharge of the slag 10 accumulating on the surface of the relatively pure lead 11. Gas burners 12 are provided through an end or side of the furnace 1, the discharge end or nozzle 13 thereof being adjacent the top of the lead bath and in close proximity to the entrance 14 from the charge door 7 so that the incoming scrap or lead alloys will be readily smelted or melted by the flames discharging from the nozzle 13 of the gas burner and then spread upon the surface of the bath 11.

The gaseous and volatile constituents rising in the compartment or charging chamber 3, pass through the outlet 15 and stack 16 to trails and bag houses where the cooled particles are collected. In view of the corrosive effect of slag and ingredients at high temperatures, the furnace 1 as well as the furnace 2 are composed of or lined with magnesia brick 17, the furnace 1 being shown as reinforced by means of steel plates 18 and structural members 19 and 20 tied together by suitable brace means or tie-rods 21. The bridge wall 5 is likewise constructed of magnesia brick as is the bridge wall in the furnace 2.

In an end wall of the furnace 1 is provided an opening 22 having a lead discharge 23 for discharging the refined metal, in the present embodiment lead, through a gravity feed 24 into the interior of the second furnace 2. It is to be understood that the slag discharge 9 is at a higher level than the lead discharge 23 to permit a continuous discharge of the accumulated slag and refined lead from their respective discharge outlets. This interior is likewise divided into two compartments, the compartment 25 receiving the lead overflow from the furnace 1, while the second is the refining chamber 26 separated from the compartment or chamber 25 by a bridge wall 27 similar in construction to the bridge wall 5 of the furnace 1. As in the construction of the bridge wall 5, the bridge wall 27 extends for the full height and width of the interor of the furnace 2, the only outlet therefrom being a series of openings 28 at the base thereof. These openings 28, there being disclosed three of the same although any number may be employed, are the only outlets for the molten metal from the compartment 25, there being however an outlet 29 for gaseous or volatile constituents which pass upwardly through this outlet and through a stack 30, to trails and bag houses (not shown). Gas burners 31 having their nozzles 32 in close proximity to the bed of metal in the compartment 25, project a flame downwardly on this bed thereby keeping the inflowing metal at a high temperature, as likewise keeping the metal in the compartment 25 at a degree of temperature sufficient to allow for separation of the impurities from the pure metal, which in the present case is lead. A side door 33 and slag overflow 34 are provided in a side wall of the furnace 2, the overflow permitting a continuous discharge of the slag

and the accumulated impurities, while the door 33 permits access to the interior of the chamber.

Provided in an opening 35 in another side wall of the furnace 2, is a lead discharge 36 located at a lower lever than the slag overflow 34, permitting a continuous discharge of the relatively pure lead into a container or ladles provided therefor. Suitable upright structural members 37 provided on opposite sides of the furnace 2, and connected together by suitable bracing or tie rods 38, structurally reinforce the side walls of the furnace which are disclosed as seated upon a base of concrete or the like 39. Likewise, the furnace 1 is mounted upon a base 40 of concrete or the like.

In the operation of the furnace 1, an initial bed of relatively pure metal, in the present case lead, is placed therein to a predetermined depth when the pure metal is in a molten state, this depth being such as to prevent any overflow of the pure metal through the slag overflow or outlet 9. The gas burners 12 having their discharge outlets or nozzles 13 adjacent the bed of the material in the furnace 1, will maintain this bed in a molten state at a high temperature. The impure metal from which it is desired to reclaim the relatively pure metal, is then fed into the furnace in the form of scrap, pig, dross, skims, etc., directly onto the surface of the mass of molten pure metal. When this scrap or the like contacts the bath of relatively pure metal, the same is almost instantaneously melted by reason of the high temperature existing in the furnace chamber, and this molten scrap immediately spreads upon the surface of the bath 11. The relatively pure metal being of greater specific gravity than the slag 11, will gravitate in the bath 11 while the accumulated slag which remains on the surface of the bath 11 is discharged through the overflow 9 into suitable receptacles provided therefor.

The relatively pure metal gravitating in the bath 11, will pass through the openings or outlets 6 in the base of the bridge wall 5 into the refining chamber 4 from where the refined metal discharges through the outlets 23 and 24 into the compartment 25 of the furnace 2. In this chamber, the discharged metal 41 from the furnace 1 spreads upon the surface of the bath of pure metal 42. Both the partially refined metal 41 and the pure metal 42 is kept at a high degree of temperature by reason of the burners 31 projecting flames upon the surface of the metal. As clearly disclosed in the drawings, the bath 42 is of considerably greater depth than the bath 11 in the initial furnace 1. In a manner similar to the separation in the furnace 1, the relatively pure metal separating from the partially refined metal 41, gravitates in the bath 42 and then passes through the openings 28 in the base of the bridge wall 27 into a refining chamber 26 from where substantially pure metal discharges through an overflow 36. It will thus be seen that there is a continuous separating of the relatively pure metal or lead from its impurities, the original baths 11 and 42 being gradually discharged into the refining chambers, and replaced or displaced by the separated relatively pure metal that is being reclaimed. As in the furnace 1, the slag overflow 34 of the furnace 2 is positioned at such a height as to keep the bath 42 at a constant depth, the slag from the partially refined metal 41 discharging through this overflow 34 into suitable receptacles provided therefor. The gases passing through the stacks 16 and 30 will carry therealong gaseous and volatilized particles which become condensed when passing therethrough, the particles being discharged in bag houses.

Although the invention has been described as being for the reclaiming of relatively pure lead, it is to be understood that the furnace construction herein set forth is adapted for the reclaiming of various products, materials and metals, as well as by-products which may be warranted.

Having thus disclosed my invention, I claim:

1. A furnace comprising a chamber, a bridge wall for dividing said chamber into a charging compartment for the reception of impure metal and a compartment for the reception of the refined metal, said bridge wall being provided with an opening so positioned as to permit the transfer only of the refined metal from the charging to the refining compartment, a burner within the charging compartment adapted to smelt and reduce the charged metal, a slag discharge for removing the accumulated impurities from the charging compartment, and a discharge for the refined metal collecting in said refining compartment.

2. A furnace comprising a chamber, a bridge wall for dividing said chamber into a charging compartment for the reception of impure metal and a compartment for the reception of the refined metal, said bridge wall being provided with an opening so positioned as to permit the transfer only of the refined metal from the charging to the refining compartment, means within the charging compartment for smelting and reducing the charged metal, a slag discharge for removing the accumulated impurities from the charging compartment, and a discharge for the refined metal collecting in said refining compartment.

3. In a furnace construction for reclaiming lead, a wall for separating the interior thereof into two compartments connected by openings in the base thereof, one of said compartments being for the reception of a charge of impure lead and the other for the reception

of refined lead from the first mentioned compartment, a burner in said first mentioned compartment having its nozzle discharging in proximity of the charge for readily smelting the same, a slag discharge from said first compartment, and a discharge for the refined lead from said second compartment.

4. A furnace comprising a chamber, a bridge wall for dividing said chamber into a charging compartment for the reception of the impure metal and a compartment for the reception of the refined metal, said bridge wall being provided with openings for the transfer of the refined metal from the charging to the refining compartment and said openings being so located as to prevent the transfer of accumulated impurities collecting in the charging compartment, into the refining compartment, a burner adapted to project its flame against the charge of metal in the charging compartment to readily smelt and reduce the same, a slag discharge for removing the accumulated impurities from said charging compartment, and a discharge for the refined metal collecting in said refining compartment.

5. A furnace comprising a chamber, a bridge wall for dividing said chamber into a charging compartment for the reception of the impure metal and a compartment for the reception of the refined metal, said bridge wall being provided with openings for the transfer of the refined metal from the charging to the refining compartment and said openings being so located as to prevent the transfer of accumulated impurities collecting in the charging compartment, into the refining compartment, a burner adapted to project its flame against the charge of metal in the charging compartment to readily smelt and reduce the same, a stack for receiving and leading away gases and volatile constituents from said charging compartment, a slag discharge for removing the accumulated impurities from said charging compartment, and a discharge for the refined metal collecting in said refining compartment.

6. A furnace construction for reducing lead alloy and impure lead and reclaiming the lead, comprising a pair of furnaces connected in series and providing a step by step separation of the lead, a bridge wall for dividing the interior of each of said furnaces into two compartments, one compartment in each of said furnaces adapted to receive the impure lead, and the other compartment for receiving the lead refined in said first mentioned compartment, said bridge walls being provided with openings permitting the transfer of the relatively pure lead to said refining chambers but preventing transfer of any collected impurities thereto, and means in each of said furnaces for heating the impure lead.

7. A furnace construction for reducing lead alloy and impure lead and reclaiming the lead, comprising a pair of furnaces connected in series and providing a step by step separation of the lead, a bridge wall for dividing the interior of each of said furnaces into two compartments, one compartment in each of said furnaces adapted to receive the impure lead and provided with means for smelting the same, and the other compartment for receiving the lead refined in said first mentioned compartment, said bridge walls being provided with an opening permitting the transfer of the relatively pure lead to said refining chambers but preventing transfer of any collected impurities thereto, the second of said furnaces being at a lower level than the first furnace to permit a gravity flow of the refined lead from the first furnace to the second furnace.

8. A furnace construction for reducing lead alloy and impure lead and reclaiming the lead, comprising a pair of furnaces connected in series and providing a step by step separation of the lead, a bridge wall for dividing the interior of each of said furnaces into two compartments, one compartment in each of said furnaces adapted to receive the impure lead, and the other compartment for receiving the lead refined in said first mentioned compartment, said bridge walls being provided with openings permitting the transfer of the relatively pure lead to said refining chambers but preventing transfer of any collected impurities thereto, means for heating the impure lead and a slag discharge from each of said furnaces.

9. A furnace construction for reducing lead alloy and impure lead and reclaiming the lead, comprising a pair of furnaces connected in series and providing a step by step separation of the lead, a bridge wall for dividing the interior of each of said furnaces into two compartments, one compartment in each of said furnaces adapted to receive the impure lead, and the other compartment for receiving the lead refined in said first mentioned compartment, said bridge walls being provided with an opening permitting the transfer of the relatively pure lead to said refining chambers but preventing transfer of any collected impurities thereto, means for heating the surface of the body of impure lead in the compartments initially receiving the same for reducing and separating the lead from its impurities, and a discharge for said impurities.

In witness whereof, I hereunto subscribe my name to this specification.

ROY CUMING BRETT.